

CONDENSED INFORMATION ABOUT THE
LOCATING OF
METALLIFEROUS ORES, PETROLEUM
NATURAL GAS, SUBSOIL WATER, ETC.

BY

ELECTRIC PROSPECTING

WITH

SCIENTIFIC INSTRUMENTS



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ERNEST W. MILLER
GEOLOGIST

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PREFACE.

The author feels the need of condensed information to help to throw light on a vital question of great economic importance to the whole human race—The Electric Prospecting.

This line of science is only in formative, yet it has been already abused by all kinds of imposters and fakers, so that an average practical oil man or miner is not inclined to listen to any device user, scientific or ignorant; but the time is at the door when instruments, based on scientific laws of nature, will help the man to locate the treasure houses of mother-earth; and any man, regardless how highly recognized authority, attempting to deny it, expresses not an opinion, but merely confesses his ignorance.

The writer claims no originality for any new idea, but acting like a judge on circumstantial evidence, has only concentrated theories and experiments of many leading scientists, and formed them into a whole for explaining the natural phenomena of locating ores, water, petroleum, natural gas, etc.; corroborating the words of Tyndall: "Taking our facts from nature, we transfer them to the domain of thought; look at them, compare them, observe their mutual relations, and bringing them ever clearer before the mental eye, finally alight upon the cause which unites them."

This little paper is far from complete, but a boundless field is opened for any thinking man in those lines. Here is place for many inventions, to benefit the inventor, miner, landowner, investor and everybody at large.

"A few words to the wise may be worth mountains of gold."
"You shall know the truth, and the truth shall make you free."
"Prove all things and hold fast that which is good." "The great profits in business come from doing something what others do not know how to do. When a line is new, few understand it and it offers good opportunities for profit. As it becomes generally understood, the profits decrease," and, finally, "everybody's business is nobody's business."

Our limited space allows only to touch certain questions and to point to the unlimited possibility the electric prospecting will have in geological works, but the author is preparing for print a book intended to serve as a guide for geologist and prospector and is especially intended for locating oil and gas. It will embrace all known geological methods, will have a chapter about botanical observations and will treat fully on all known electrical devices. It is based on author's personal experience and on patent records of U. S., England, Germany and France. The book will be profusely illustrated.

April, 1917.

E. W. M.

Theories and Facts.

While this is an attempt to explain the facts theoretically, we have to give due credit only to facts. "Phenomena are alone explained by description of their process and functions." We are living in a great mess of mysteries and if we would not accept the facts without "why"—then, we could not possibly live, for life itself is an unexplained mystery, e. g. "From whence the force or power emanates, which produces the wonderful physical phenomena, a human form, by adding to a microscopic, protoplasmic speck, other microscopic atoms; a wonderful influence of unseen force, intelligent, active, persistent and eternal?" That force what, using the words of Arthur Schnitzler, the superstitious calls—Fate, the fool—Chance, the pious—God, and the wise—Force that has been from beginning of all days, still is and works unrestricted in eternity. A single cell of simplest protoplasm climbing in nine months time the many millions of years long ladder of slow evolution, emanating to itself billions of like itself, building a human form, carrying with it the imprint of race, nationality, clan, and revealing resemblance and mental, moral and physical effects and defects of immediate parents. Nobody ever explained it, and likely never will, the animation, or the phenomena called life; yet, we know we live and some of us mighty fast, too. Who explains "why" our body, composed of 75 per cent of water and some 14 well known original elemental chemicals, a food burning engine, has something in its gray matter for "God like" thinking and accomplishes wonderful results in harnessing the forces of nature, and fully rules the physical body—its carrier? This intelligence, which, Sir Archibald Geikie said, "will make us fellow workers with God." Yet, we know it is so. "I have found," said President Wilson, "in the course of life that the particular thing that you have to surrender to is facts." Huxley and Fleming encouraged the "killing of beautiful hypothesis by ugly facts" and Bacon, in his "Novum Organum," calls the hypothesis "only idols of theater and the den." Dr. Geo. C. Simpson points out that "our ideas of the axioms of physics are at present in such a state of flux that it would be difficult to state exactly what they are." Theories may come and go, but facts remain with us, regardless, whether we can account for them or not. But, knowing them, we can utilize them to our benefit.

In an eastern legend, "The Mirror," Confucius writes that the primitive man considered everything he was able to understand—nonsense, and things he did not understand were—miracles. Now we meet certain individuals who are led to believe and trying to lead others to believe that they know everything. If asked to explain phenomena, like one in question here, they dispose it by claiming that "there ain't such animal." It is closing ones eyes and imagining that others do not see us, or like ostrich hiding its little head under the sand and imagining that all that big bird is invisible to the enemy. Not by shunning and denying the facts we can learn to know them and benefit by knowing them.

Nor are the actions of every invention, based on natural phenomena, explainable. C. C. Everett, in "Poetry and Duty," page

14, points out that "genius works less by a process of conscious reasoning than by a flash of intuition, and less by abstract conception than by prophetic beholding of results." Ever the most advanced of us are compelled to admit phenomena what no gnosis reached to clear. The ancient acataleptics taught that knowledge never amounts to certainty, but only to probability.

New Ideas and Human Conservatism.

Instead expert, impartial and unprejudiced investigation, the electric prospecting and "water witching" have been ridiculed by supposedly wise, hopelessly conservative and instinctively shunning any new idea individuals. Others, afraid of ridicule and too indifferent to investigate, have willingly submitted to such ruling opinion.

Spencer says: "Nothing obstructs progress more than ignorance and prejudice"—both have been working overtime in this case; and Kekule said: "It does not pay to sit back and say: 'This cannot be done because it has never been done,' discoverers in all lines have just begun to scratch the surface of human possibilities." "The eyes of the masses are blinded by the force of established things and it is hard for one to declare his independence of conventionality and long recognized authority and to be a pioneer to blaze a new path in some undiscovered realm of human possibilities." Sir Oliver Lodge says: "The wide spread ignorance of natural facts, ever among our leaders, and consequent contempt for investigation and expert knowledge—is a danger." Dr. Woods Hutchison writes: "Your hard headed, practical man, who has no use for new fangled theories, is really the most inveterate and bigoted theorist on earth, who has inherited half of his working beliefs and jumped to the other half on very inadequate evidence." Investigation is fatal to most common beliefs. Dr. W. C. Bitting characterizes very correctly our average man, or as the Philosopher Lambrozo puts it, "domestic animal,"—in following words: 'Oh, these new fangled notions,' "you may say," 'my father never taught me that, and I never heard of that.' "Well, suppose you did not? Does wisdom end with your father or with you?" The progress of our days is moving so fast that your father, if dead twenty years, was only a mere ignoramus comparing with us today and if you are what you learned while in school, why—man, you are a back number, a negative cog, more harmful than useful. "There is an aristocracy of stand-stillism which presents the most marked opposition to advancement," says Dr. Willard Carver. With the phenomenal unfolding of our present scientific era, many valuable phenomena, often unrecognizable in mystic garb of superstition, were, in most cases without a fair trial, or trial at all—condemned, and their believers suffered but little less in the hands of modern science than their ancestors subjected to tortures of inquisition in middle ages. Every now and then some thinker peels off the ages old strange coverings of such facts and finds valuable additions to our modern science. Similar is the case with our present subject.

Certain young men, in employ of Uncle Sam, supported by some physicians, for narrow minded, professional reasons, after a

few unsuccessful and haphazard experiments, hastened to condemn the so-called "mad-stone" as a fake and fraud.

The writer, after many experiments, has established as a fact above any doubt that certain minerals, under certain favorable conditions, coming into contact with animal muscular and nervous systems by forming a bridge for opposite electric currents in nerves and muscles, effect a galvano-plastic action with resulting deposition of the foreign matter on the mineral or "mad-stone." But this will be a case to discuss later, in another paper.

R. M. Hunter, the master inventor and world-wide known scientist, said lately: "I can remember when the exploits of Darius Green were accepted as the last word in aviation. I can remember when popular science magazines 'proved' that the horseless carriage could never become a commercial success. As for X-rays and wireless telegraphy, they were absurd; as absurd as the dream of those ancient alchemists who thought they would some day discover how to turn ordinary metals into gold." Yet there is no doubt, that synthetic gold has been found by archaeologists in ruins of far East. It is not very much out of place to mention that the same savant adds: "I can manufacture gold not only from the baser metals, but from common mineral substances, even from water and stone. I am making it; I have been making it for years." There is nothing surprising in those claims. The possibility of it has been admitted by all leading scientists long ago, in fact, since the possibility of transmutation of elements was known from experiments of Sir William Ramsay. But, let's turn back to our subject.

In all ages the world has been too stupid to appreciate its benefactors. So it is today. Only coming generations will see and value the present day martyrs of progress. It takes generations of time to change the mind of masses. "Only a genius sees the abstract truth," while, according to Prof. Becker's words, out of 25,000 human beings only one can really think. Then, what chance has one to make himself understood in anything where thinking is needed? As the quotation from Henry Sedgewick goes: "We think so because all other people think so; or because—or because, after all, we do think so; or because we once thought so, and think we still think so; or because having thought so, we think we will think so."

"Life" has catalogued the people in the order of their number: "Those who do not think, those who think they think, those who think wrong and those who think."

Seldom a reformer and inventor benefits personally from his work. We are used to see him—solus, pauper, nudus. Charles Goodyear died practically a pauper, yet others are making millions vulcanizing rubber after his method. "Even after the telegraph was successfully demonstrated, its inventor, Samuel F. B. Morse, had to suffer for years, extreme poverty and misery."

"All the forces of incredulity that ignores, the conservatism that hates, the ridicule that mocks what is new, were brought to bear to oppose George Stephenson's great invention. The very idea that a steam drawn train would be capable of traveling at a rate of speed equal to the fleetest horses, was 'a most absurd

extravagance.” It was 1825, yet human mind is not changed. If anything new is offered him, what his wild running brains cannot comprehend at once—he revolts, or instinctively shuts up his valves. “A fool you can neither bend nor break.”—Epictetus, Harvard Classics, 2.

“The printing of books by Johann Gutenberg was called ‘witchcraft’ and ‘an instrument of the Devil’ by the masses of that day.” These masses are still living, though it was 400 years ago. There is never end to them. Mothers do not dump them into the world wiser now than then.

“After many years of struggle with obstacles and disappointments, due to ignorance and malice, Christopher Columbus succeeded in his enterprise, only to die penniless and broken-hearted over the shabby treatment accorded him by the country for which he gave so much.”

“People sneered scornfully when Robert Fulton first endeavored to drive a boat under its own steam.”

“Insults were heaped on John Ericsson in spite of the splendid services given by his Monitor. His idea of revolving turret is now used in all modern warships.” The sneers and ridicule of supposed wise will not stop the progress of the world, although it generally retards it.

“Only envy, hatred and malice moves the mind of average man.”

“Sir Walter Scott, great as was his admiration for James Watt, made various smart jokes about the absurdity of William Murdock of lighting London with gas,” and in the House of Commons, Murdock was taken for a crazy man, yet the London Gas Light and Coke Company has today a capital stock of \$150,000,000.00 and sold last year about twenty-seven billion cubic feet of gas. Average man is a mental buzzard who cannot swallow any idea which does not stink of dead men and their dead ideas.

“Most of us men are moles,” said Rev. Hubert, “scratching their way blindly through life, without thinking or learning,” and Rev. Sheldon Griswold adds: “Most people lose themselves in some of the every day things of life. They cannot sit down and think.” No, indeed not, and they hate to see anybody else doing it for them, subjecting them to ridicule and hate.

“Samuel Pierpoint Langley really died of a broken heart over his failure to obtain recognition and support for his invention, yet flying machines are today in use, the exact copies of Langley’s invention.” Masses must be “shown”—they cannot think, they cannot imagine a simple possibility, ever if explained. Only a wise man can be convinced and converted—fool never.

“Galilei Galileo suffered long time imprisonment and torture for ‘absurd philosophy,’ claiming that ‘the world revolves.’ It was found ‘heretical because contrary to Holy Scripture.’” “Pioneers and founders of new systems cannot be slaves of old conventions and customs.” We see the sufferers for progress in past, but many thousands are today on the same thorny road, unseen, unheard. Our masses today are in an equal mess of antiquated beliefs and non-beliefs towards possibilities in new and unexplored lines. Our swell dressed, well fed, supposedly civilized average man, knows

not more, and cares to know less, about the natural facts, than our paleolithic, hairy and naked ancestors, shivering in the dark and damp caves and mumblingly gnawing the bones of their kin.

It has always been so and will be so. Stoic, Tacitus, in *Annals*, about 2,000 years ago writes: "We extol the old and disregard the new." The older an understanding, the more primitive and more barbarous it is. Average human being thinks nothing but *panem et circences*—food and fun. Mommsen's words: "Over whose heads the history of a thousand years has passed without leaving a trace," applies here and today. (*Historian's History of the World*, vol. VI, p. 85.)

"The world would not have progressed very much if there had not been in every age a few people who had the courage to defy the conventions of their time and launch out on something new and revolutionary. These are the real reformers, although many of them had to give up their lives for their temerity, and many more never saw the reward of their efforts left for coming generations to realize. This old world would be at a sorry standstill if everybody made up his mind that whatever was good enough for dad is good enough for me. Inaction is retrogression, for nothing in nature stands still—we have got to advance if we do not want to slip back. So we are very much indebted to those courageous souls who made themselves the targets for the 'arrows of outrageous fortune' and suffered contempt, ostracism and even persecution that we of a later day might find a better way than our fathers of old. It will be a sad day for humanity should this breed of humans ever perish from the earth.

"But what a life it is, to go through the world thinking other people's thoughts, and doing other people's deeds.

"The purely conventional, wholesouledly fashionable man contributes absolutely nothing to the progress of the world. As far as he can he leaves everything, from dress to morals, exactly where he found it, only a little shopworn. He never feels the thrill of a little new idea, all his own, never thought in quite the same form by anyone else before. In short, he never lives a life of his own. He is only a shadow of somebody else.

"It is better to be distinguished, even by a grease spot, than to be a meaningless blur in a crowd."—*Tulsa World*.

"While you labor, dig and seek,
Dull of eye and gray of cheek;
While you study, delve, explain,
Define, example, think refrain,
Ponder on the meaning of
Life and death, and joy and love,
Laws discover, reasons frame,
Fools are playing at the game."

—*New York Sun*.

"And there you are," as Henry James loves to express.

We were called into this world as co-workers with the infinite intelligence, of which we are and remain an undividable part and one has no right to hide his own or his neighbors' candle under the bushel, that mankind may be lifted higher mentally, morally

and physically, to fulfill the will and aim of the Good—the progress. Not “riding” our brothers but utilizing the forces of nature and fighting the ignorance we do our duty and attain the highest satisfaction, the Godly satisfaction and the noblest and purest joy, the joy of creation, the most elevating feelings what no man can know who sees his purpose only in selfish, parasitic and mere physical existence, chasing only the flamboyant and tasteless materialism.

One reads with pity that some recognized authorities in geology think it their duty to express it possibly strong that they know nothing and care to know still less about the “forked twig, crooked stick” and other devices. While one must not believe anything before fully investigating and convincing himself, it is miserable low for a man of education and supposed to be able to think, to follow the crowd in their ancient beliefs and prejudices. A man of education, without independent thinking ability is as worthless for the progress of the world as a plaster pattern of a gold coin in the hands of a hungry tramp.

A great majority of our professional classes, perhaps 90 per cent, are hopelessly unprogressive, believing that all there was to learn was learned in college. They are glass bottles where you cannot put a drop more in today than years ago, while the world is moving fast and who climbs not—slides. We would not have a legion of all kinds of sects if the priesthood was ready to absorb new and useful. We cannot be fed on thousands of years old dogmas, even if they were dictated by God himself. Progress is the law of nature. We have got to move or be crushed by it. If physicians, as a class, could not be blamed for the same sin, there would not be Christian Science nor chiropractics to contend with.

The same applies to geologists. Average geologist is average man, plus training. He is adverse to anything new, like his brother, average man—unprogressive, finished on the school bench. If all geologists would follow the new scientific discoveries and investigate natural phenomena, there would not be ignorant mineral rod men disgracing the profession.

There is nothing to be upheld as absolute and nothing to be condemned entirely. Only running water is fit for consumption. Only progressive minds are useful. Dogmas, ideas, enterprises and governments imposed by demagogic brutes as absolute and not subject to improvements, will crumble into dust with their supporters.

On the meeting of the American Association for the Advancement of Science, in New York City, Dec. 26 to 30, 1916, Professor Edwin G. Conklin of Princeton University, speaking on “Biology and National Existence,” made these statements, to which many called attention:

“Science holds the key of the future. Our destinies are in the hands of not rulers but of investigators. National existence depends on the conquest of nature rather than on the conquest of nation.”

Feasibility of Electric Prospecting From Logical Standpoint.

Your face is the mirror of your soul. A single leaf identifies a large tree. A drop of blood tells in whose veins it was pulsating. Now comes Dr. Berillon with his Ethno-Chemistry and tells a man's race and nationality from a single drop of his blood. Not only that, family relations can be detected by the same means. A piece of petrified bone is sufficient to build a model of a giant animal, extinct millions of years ago. A single act, a single word may reveal your life-story. The shape and appearance of a tree, like that of a man, tells its sufferings, its food supply, tells about the sub-soil, its roots were and are penetrating, tells about long-lived regular or unregular seasons and tells what is far below its roots. Flowers, insects, climate, grass, water, storm and sunshine—all are great open books to read about the locality where they are—a great book of an endless source of precious information to one who understands to read it. Prof. Swine says: "The educated mind understands the language of the field and forest," also of the earth and heaven. If a single molecule is sufficient to tell all about the element it represents, if a single individual reveals his racial signs and recollects in our mind all the long history of his race, which was the cause of appearance of the individual, why then not, for one who sees, is a congregation of all such and similar signs—the open book of nature where "everything goes by law," a source of endless information? How closely all things in this universe are connected by mutual influences, even the farthest suns and stars, we see from W. F. Carothers' methods of forecasting twenty-five days and more of storm, cold waves and cyclones, by observing sun spots. Emerson says: "Let every man learn that everything in nature, even motes and feathers, go by law and not by luck," and Henry Drummond says the same in other words: "Nothing that happens in the world happens by chance. Everything is arranged upon definite principles, and never at random."

"Natural law is a disposition of things to act always in a certain way, which may be reduced to a mathematical certainty. This universe is governed absolutely by the laws of nature, by which every effect must have an adequate preceeding cause, which will, in turn, be parent cause to a successive effect, from which we have a rotation of causes and effects or a sequent order of nature;" thus seeing the effects, we can know the unseen causes.—"How above so below."

The whole universe is an endless chain of ever rotating causes and effects.

"Causes and effects are eternal arrangements, set in the constitution of the world."—Drummond in *Pax Vobiscum*, page 58.

Romans knew the laws of causes and effects: "Me and my children if the gods neglect. This has a reason too."—Marcus Aurelius.

A progressive farmer knows that it would be a folly to plant leguminous crops on ground growing blackberries and sour grass before draining and "sweetening" the soil. Cattlemen know the health of an animal by the lustre of its hair. Dentists can detect

many diseases through teeth. A good oculist locates many, if not all maladies, in remote parts of the body, by looking into eye, reading the biography, pathology and prophecy, all in one. A single hair under the microscope may reveal your race, habits, health and aspirations. A physician cannot see skin-deep into anybody's body, but every malady is accompanied by its own visible and feelable symptoms—which are effects of unseen causes. Knowing the symptoms—he knows the sickness, and knowing the sickness, applies the cure. Geologist cannot see deeper into the ground than anybody else, but at his disposal are all kinds of guides to unseen causes. Like a lawyer, knowing the laws of the country and knowing all sides of a case—is certain about a judge's pending resolution, so geologist, knowing the laws of nature, knowing the strict rules of the universe from suns to electrons, knowing the many millions of years reaching back physical history of the world, helped by chemistry, microscopy, botanics, electricity, and, in fact, all physical science, is able to detect effects and applying the laws of nature—knows the causes of such effects, and so is able to point to the places where nature has stored up its treasures, as a result of complying with the laws of the universe. To find the murdered man in the swamp—look into the sky for buzzards.

“The world is the geologist's great puzzle box. He stands before it like child to whom the separate pieces remain mystery till he detects their relation and sees where they fit, and then his fragments grow at once into a connected picture beneath his hand.”—Agassiz, *Geological Sketches*, sketch i, p. 11.

One would hardly think that close observing of such widely disconnected and apparently meaningless things as squirrels, grasshoppers, bees, grasses, tree buds and bark, nuts, snakes, cornhusks, weed seeds and a host of other things will enable John T. Timmons, the distinguished horticulturist and weather forecaster, to predict weather and seasons. Like coming events are casting their shadows ahead, so passing events are writing their story in vivid pictures, and long past events have left their hierographs in everything that nature ever puts its hand on. If you don't see it, if you don't understand it—don't let that be a cause of denying it.

Faraday pointed out in one of his lectures, that there are “Tongues in trees, books in running brooks, sermons in stones, and good in everything.”

A new line of science in geology is in formative. It is tracing the economic minerals by petrified mussel evidence. E. g., Indicative of underground water is the fossil mollusk *Inmeramus*, or its distant relative, *Corbula Unger*. The minute Echinodermata indicates coal deposits. *Halymenites major* and *Corbula Undifera* are also predictors of coal. *Halymenites*, a fossil algae, is found in Rollins sandstone, and is associated with high grade bituminous coal. *Geonimetes Unger*, a palm, recognized by its corrugated surface, accompanies a low grade of bituminous vein. Certain kinds of coal deposits in each region have their own indicative fossil remnants. Phosphate rocks are associated with fossil *Meekoceras*. This type is found in Anhareb formation, lying 1,200 feet above the

phosphate bearing rocks in Idaho. A little petrified fossil, discovered in a water well in Louisiana led to the discovery of the Spindletop with its 70,000 barrels of oil daily and several clusters of oil wells in the same state. A piece of petrified shell, hundreds of feet above the petroleum stratum, may lead to valuable deposits. A fraction of a pebble hundreds of miles away in some river bank, may tell where to look for mineral.

Now, allow me to point out once more, that each petrified species are guides to certain deposits far below. It is only logical to ask, why is it so? Why certain living beings or vegetation flourished above certain economic deposits and not elsewhere? Because the conditions were favorable? But the same conditions prevailed not only on certain spots; they were broad. We must conclude that electric currents present and characteristic for each element, had much, if not all, to do with it. If this occurred before Adam was made and Eve fell, when our ancestors, perhaps tiny fishes, first time lifted their scantily brained heads playfully or food or oxygen seekingly out of Paleozoic oozy slime and then, when, (using the remarkable verses, "Evolution," by Langdon Smith)

"We were Amphibians scaled and tailed,
And drab as a dead man's hand;
We coiled at ease 'neath the dripping trees,
Or trailed through the mud and sand;
Croaking and blind, with our three-clawed feet
Writing a language dumb;"

then, is it not today so? The original laws of nature are not changed. No revolution has taken place in slow walk of evolution. Then and therefore, it must be so also today, and living beings and growing vegetation of our time are also guides to economic wealth far below, and there is no real need everywhere to dig the graves of our honorable ancestors to locate it. Using the verses of Smith again:

"Our trail is on the Kimmeridge clay,
And the scrap of the Purbeck flags,
We have left our bones in the Bagshot stones,
And deep in the Coralline crags."

So everything else in this world has left its "trail," and reading the massive pages of the great tragical history of the world, the pages, often thousands of miles long and wide and sometimes thousands of feet thick, the stratified rocks, we see the endlessly rotating strange cycles of life and death with its causes and effects to the last word of the strict, merciless, just to cruelty, wise above imagination and unavoidable laws of the nature. There is no forgiving, no exceptions, for it would break the wise laws and ruin the order. Nature cares as much for a nematode as for a man.

It is generally recognized that many, if not all minerals, have certain surface indication, e. g., sulphur has white earthy rock or borscale, metalliferous veins have gossan of Cornwall, petroleum favors or disfavors certain vegetation, etc., what is a direct result of electro-chemical action on surface rocks or soil.

Analyses of Mr. E. T. Wherry, of the U. S. National Museum, of the soils of several states, proved that the calciphilous (lime loving) plants are found on soils high in both total and soluble lime.

Director of Oklahoma State Geological Survey, Mr. C. W. Shannon, in a personal letter to the writer, says: "One of the main things from the geological standpoint is that there is such a close relation between surface vegetation and surface geology. I believe that in many cases where structural relation is such that it cannot be mapped from the surface geology, and the occurrence of the native plants is of great aid in this particular thing. For instance, I have been making diligent search for sycamore trees growing in the Permian Redbeds, as well as where not influenced by limestones in the formations. To the present time I have failed to find any sycamore trees growing under these conditions, yet just across the line of contact on the red Pennsylvanian where, from all general appearances conditions are the same, sycamores abound. I might also mention a condition in northeastern Oklahoma where, while the persimmon is common to the whole region, its occurrence on a particular limestone formation is that of peculiarly dwarfed growth so that even at a distance the occurrence of the limestone region can be picked out.

"These are only two instances that show the relation of native vegetation to surface geology. I have been gathering data on this ever since I have been engaged in geological field work and the publication is being prepared as a side issue." Mr. Shannon addressed the second annual convention of Southwestern Geologists' Association, in Tulsa, Okla., Feb. 9 and 10, 1917, about the "Relation of Surface Vegetation to Surface Geology."

There is something in similarity. Something that is not only limited to human face or shape, not only to plants or minerals of a certain narrow district or a part of the globe; no, it embraces everything, our earth, all planets, the whole universe. "Edward Hargraves was so impressed with the similarity between the gold-bearing rocks of California and the rocks along the Macquarie that he hurried back to Australia and had the satisfaction of starting the peaceful colonies by the discovery of gold in New South Wales in February, 1851."

By long series of experiments of many naturalists it has been established long ago that plant life is and can be stimulated by electric currents.

"Some plants need certain metal salts for their proper growth; others, when they take up certain salts, show characteristic change in leaf and flower. The violet, *Viola Lutea* Var. *Calaminaria*, grows upon zinc deposits; the butterfly flower, *Amorpha Canescens* Nutt., grows on clayey plumbiferous soil in Missouri; and clove, *Polycarpaea Spirostylis*, grows on cupriferous soil in Greenland, the ashes of which contain copper." (Prof. Keischlag). A notable vegetable in absorbing minerals is Pacific Ocean kelp, which is a good source of potash. The bark of the Brazilian tree *Moquilea utilis* is a source of silica for pottery industry. Now, admitting that there is an electro-chemical change in the ground above mineral deposits, then everything coming into contact with it, like

vegetation, feeding of it, is influenced in its color, shape, health, etc. If "you are what you eat," then this applies also to everything else. So marked are such indications in most cases that one traveling, on a fast train, steamboat, automobile, looking into binocle miles away, or even observing from aeroplane, can map the favorable places where to prospect for certain minerals. It is evident that all above described indications will have their different electric currents, which can be detected by suitable devices, for, as will be explained farther, electricity is the cause of every change in nature.

History.

The dawn of the history of ferreting minerals and "divining" water dates back to the time of the world rule of Atlantis, or far beyond modern history.

The terrible war fire of Greeks and Romans was an inheritance from the gods and kings imported from Atlantis (a great island in the Atlantic ocean, now submerged), and is claimed to be a mixture of heavy crude oil, unslaked lime and salt. The "God-like" citizens of Atlantis were very highly cultured and very likely mined the oil on their home-island, which made them devils in battle and gods in peace for the rest of the world.

As far as four thousand years ago a Chinaman, Fu-ke-chang, claimed the ability of locating water and metalliferous ores, and Pliny mentions of a Greek doing the same with some kind of an instrument. Doubtless, such knowledge, together with all other Eastern science was inherited from Atlantis.

In middle ages, in Christendom, every natural phenomenon that did not find explanation in the Bible was condemned as "witchcraft" and everybody practicing it was heartlessly tortured and ruthlessly destroyed.

Up to our days science refused to consider any facts, and ever denied such natural phenomena, not having ready theories to explain them.

In later years the men of psychic research have done great work to call the World's attention to the endless facts recorded in all parts of the world by many eminent men, though it really has nothing in common with psychics, if not to consider human slowness to understand it. Only recently science has readily admitted such facts and finds its explanation in terrestrial electricity and already several scientific instruments are invented for said purpose. It is human nature to ridicule and to shun what one does not understand, or understands wrong. At the present time, only those not following the events would dare to deny the endless facts, supported by experiments and affidavits of many eminent men. It would be a hopeless task to try to mention all or even a part of the facts, but it might be of interest for the reader to know that the German Scientific Congress proved the possibility of finding water with a forked twig, or like, and that the Prussian government is employing Landrat Von Ussler of Apenrade for detecting subsoil water with a common "divining rod," or a twig of willow, or some other tree. By order of Emporor William II of Germany, several divining rod men were sent to South Africa

to discover water in lifeless deserts, and many good wells were the result. Dr. T. Preyer, a scientist and eye-witness, reports that on times of the great war Major G., of the German General Staff, located many water wells in deserts of Eastern Egypt and Palestine, what greatly helped the construction of a railway to Suez canal. He used wooden and metallic rods. The writer also had successful experience by such methods. In America there are several men doing the same, among them Mr. Kellogg of Los Angeles, California.

A Few of the Scientific Instruments in This and Similar Lines.

In later years the "divining rod" has been developed into a scientific instrument for detecting water. Doctors Engler and Sieveking invented an apparatus for this purpose, which they called "Fontaktoscope," that is, spring pronouncer. Soon afterwards Macher and Meyer brought out their "Fontaktometer" and a similar apparatus was devised by Dr. Lowenthal. The latest invention in this line was made by A. Bergman, an Apothecary at Albersdort, Holesstein, who claims that his apparatus surpasses all others in greater accuracy and sensitiveness.

For detecting metalliferous ores and petroleum there are also several scientific apparatuses invented, some of them on the market, some not, for obvious reasons. Thus mining Engineer W. Mansfield, and Edwin Mansfield & Company, are marketing their apparatus. The Mansfield's apparatus was tried by the Indian Government for water finding. (See Bombay Gov. Bulletin, by Dr. Metha, No. 38). While the report was favorable, the apparatus is claimed to work too slowly. On account of there not being any other more suitable device on the market, F. A. Talbot, in "Oil Conquest of the World," pages 23 and 32-34, claims that, "the instrument has been adopted by several of the leading oil companies in various parts of the world."

Many of the earlier devices were made on so called "affinity" basis. It is widely known that certain elements have a strong affinity to other certain elements, like mercury to noble metals, magnets to paramagnets, etc., and so were utilized to indicate the presence of each other. Every piece of matter in the universe has an attraction for every other piece of matter, the force varying according to Newton's formula, by the product of their masses and inversely as the square of their distance. The affinity basis also is explained on electrical theory, as proved by observations of Bennett and Fabroni: the affinities serving as best collectors of electric energy for opposite poles, the cohesion or affinity being an electrical attraction between the atoms or molecules of a body. As conductors of such energy can be utilized all known conductors, prospectors body and ether. Prospectors body is often influenced by many agents, at times unsuspected and uncontrollable, and thus, may mislead. In case of ether the indications will appear very slowly and at times are also influenced by outside agents. Besides that, certain elements have affinity to many certain other elements and thus may indicate the elements not looked for or not desired. Direct contact prospectoscopes are most reliable. These, in turn, are sometimes influenced by chem-

ical action of local origin, but this can be easily detected by experienced prospector.

The late Geo. M. Hopkins invented an apparatus for detecting magnetic ores, which never appeared for sale, though sound as his principles were.

Prof. D. E. Hughes invented the widely known induction balance for the same purpose, which was later developed by Capt. McEvoy into a successful apparatus for detecting metals under the water, like ore bodies, sunken ships, etc., and the same method modified to some extent by the Paris Academy of Science is used now by the French for discovery of buried, unexploded shells in erstwhile battlefields. (See Scientific American of Nov. 13, 1915, page 425).

U. S. Patent No. 1,126,027 is issued to Dr. Max Jullig for an instrument adapted to locate pipes or any other metallic bodies in the walls and like, which also is based largely on the principles of Hughes induction balance.

One of the modifications of Hughes principle is used in Germany for prospecting. Thus we read in "The Treatise on Ore Deposits" by Professors Keysschlag, Vogt and Krusch: "The electric properties of deposits may also be used in prospecting on the surface," etc.

Furthermore, one of such modifications is adopted for detecting counterfeit coins and any other alloys. (Hopkins Experimental Science, pages 572-574).

In Scientific American of Jan. 8th, 1916, page 61, we read: "The application of electric waves to the exploration of the earth's interior was first suggested by Truustedt in 1901 and was subsequently and independently patented by Miller. Recently the subject has been treated, both experimentally and theoretically by Heinrich Loewy, who at first was interested in a purely scientific problem, the demonstration of the nucleus of liquid iron which Prof. Wiechert conjectures to exist at a depth of more than 1,000 kilometers. Some preliminary experiments, however, showed that facts of great importance to miners can be learned from the application of electric waves to much smaller depths. Newer and apparently more valuable methods are based on the variation of emitted waves which is caused by the electric properties of the immediate environment. The electrical methods are especially valuable in cases in which they can be employed successfully to locate water and ore without boring." Farther, the same paper relates to success of a German Company, organized for the purposes of exploiting various methods for electric prospecting.

Conrad Schlumberger of Paris, France, invented an apparatus for "locating ores in subsoil," coming into direct contact with the ground and using galvanometer and potentiometer (see U. S. Patents 1,163,468-9); but it needs strong currents to indicate and cannot define what mineral is causing the currents.

Dr. Infroit's radiological compass can accurately locate any, even smallest metallic bodies in human body. (Sc. Am. Feb. 5th, 1916, page 150). There are numerous devices on the market, under the name of mineral rods and like, some intentional fakes and most of them of little or no value. Instruments of real value have

been jealously guarded by their inventors, for their own use, and are not for sale.

The miner's compass, or dipping needle is too commonly known to need mentioning here, and it is only of use when prospecting magnetic ores and near to the surface. It is used with great success in Sweden and Norway, where the magnetic ores predominate.

One of the latest inventions in this line, and perhaps, the most developed is that of the writer, who has practiced with it for many years in three continents and has found it of incalculable value in economic geological works and prospecting. Complete maps of sub-soil oil or gas pools or ore bodies can be made at the time of prospecting. Useless to say, the prospector must possess a good knowledge of geology at the same time, or gross mistakes may be made.

Wm. Dubilier invented an instrument, whereby, in the midst of the multitude of great noises of giant steamboats, the feeble noise of a tiny submarine is detected and its whereabouts calculated, what the English used with great effect against German submarines.

Years ago, John Hayes Hammond, Jr., perfected a radio-controlled torpedo, and similar device is patented by Allan C. Canton, which by electro magnetic forces detects its prey, miles away, and chases it to doom, automatically turning after it, no matter how the victim dodges.

Prof. B. lar detects, by the help of seismograph and other sensitive instruments, battles, hundreds of miles away, calculating how far and what nationality cannons are in action, how many of them, what size and what make, what was utilized by central warring powers for their great benefit.

Radio direction finder was invented by Frederick Kolster, of U. S. Bureau of Standards in 1916.

Electroscope can detect a pin's head size piece of radium in hay stack or buried deep in the ground. Barometer tells us that the atmosphere extends but seventy miles above the earth, forecasts weather and calculates altitudes; with the help of telescope our sister planets are photographed; we see our mighty greatness in microscope and our miserable nothingness in telescope; spectrometer tells us the elemental substances constituting our sun and stars; bolometer tells the temperature of the sun to be 12,000 degrees Fahrenheit, and that of the moon icy cold; Coulombs' balance can weight the earth; applying scientific laws the mass of planets is determined and eclipses predicted. The discovery of new planets is predicted by reading the laws of nature, as was the case with Neptune, the furthest known planet, so far away that a ray of light traveling 186,000 miles in a single second would reach our earth only hundreds of years after leaving the planet.

C. G. Abbott and L. B. Aldrich invented so called "pyranometer" for measuring sky radiations, which is so sensitive that the radiations of feeblest and farthest stars, not visible by naked eye, can be accurately measured. Wireless is little short of reaching around the world. Yet, after all this, one finds masses of seemingly average intelligence and ever supposedly wise and leading men, unable to grasp, how one could detect electric currents directly under his

very feet and coming into unavoidable contact with such energy, an energy so enormous that often oil and gas drilling derricks are ruined and tools, weighing tons, are lifted out of the hole like a piece of cork, aggregating a pressure up to 1,500 pounds on a square inch, every atom of it in tumultuous attempt to escape. This force, working its way through overlaying rocks, working restlessly for many thousands of years, is penetrating it, though, possible in small quantities, but in quantities enough to detect it by sensitive instruments. No rock is absolutely impenetrable. Even the glass bottle is not impervious, in absolute sense.

Scientific Theories and Literature Applicable to Electric Prospecting.

We find many theories in up-to-date science, proving the advisability of electric prospecting. Thus, Prof. James Johnstone, of University of Liverpool, says: "Something is irretrievably destroyed in every physico-chemical reaction that occurs. This something is available energy. Energy, potential or kinetic, that is, energy of position or the energy of motion of entities possessing mass, which can be made use of in producing or setting up transformations or natural phenomena, is available energy."

Prof. Cooke in his "Religion of Chemistry" says: "Electricity is the result of every change in the nature," and we know that oil, gas and ores are a result of continuous change, in full progress at present. (See Paine and Stroud, "Oil Production Methods.")

Prof. R. S. Tarr, in "Economic Geology of U. S." points out that "vast majority of ore deposits come to their place by chemical action."

Mr. K. C. Wells, of U. S. Geological Survey, in a Bulletin entitled "Electric Activity in Ore Deposits," speaking about possibility of electric prospecting, mentions that "the data here presented are believed to possess value in broader investigation of ores, for even feeble currents might exert a directional influence on ore depositions, and chemical conditions, even at a distance, might be a factor in determining mineral association." The same author, on page 16 says: "But whatever may be its cause, the experiments indicate an effective difference in action between different minerals."

Interesting characteristic differences between metals in Electrolysis is illustrated in Scientific American Supplement No. 2082.

Mr. Becker of U. S. Geological Survey, calls attention to the phenomenon, that where petroleum is known to be, magnetic deviations are strongest, thus proving the presence of available energy.

Mr. Bauer's maps of Geodetic Survey strongly support this opinion. (See also Isometric chart of Coast and Geodetic Survey of 1915).

L. L. Hutchison in Bulletin No. 2, of Oklahoma State Geological Survey, page 143, points out that "experiments are being made in Louisiana to locate oil pools by magnetic anomalies."

Geo. F. Becker in Bulletin 401, of Federal Survey, made a brilliant attempt to explain "the relations between local magnetic disturbances and the genesis of petroleum."

The earth, in its normal state, without the presence of increased physico-chemical action, due to mineral deposits, is a fairly good electric battery, and not in far future will we know how to utilize it for light, heat and all industrial uses. Sidney Aylmer, in "Elementary Electricity," page 221, says: "Hydrogen makes a fine positive plate, just about as good as zinc, and oxygen makes a very good negative plate." The earth's crust contains 47 per cent oxygen, 28 per cent silicon, 8 per cent aluminum, 4 per cent iron, 0.17 per cent hydrogen and 0.12 per cent carbon.

Prof. Shody discovered that there is some form of radiation from chalk and granite cliffs, possible electrical, which causes climatic differences in places near together. Ernest W. Miller used thermometers and weather bureau reports, among other seemingly disconnected informations, as a great help in locating oil and gas fields.

We know all matter is composed of countless atoms.

The great French Scientist Poincare said: "Each atom is like a kind of solar system where the small negative electrons play the role of planets, revolving around the great positive central electron, which takes the place of our sun. Besides these captive electrons there are others which are free and subject to ordinary kinetic laws of gases. The second class are like comets which circulate from one stellar system to another, establishing thus an exchange of energy between distant systems."

The last named electrons are the most readily detectable source of electricity by suitable apparatuses, wherever they are present in larger quantities as normal, like at the large ore bodies, oil pools, subsoil streams, etc.

"The structure of the atom lies not only at the foundation of chemistry, but electricity and, in fact, of all physical science." (Sc. Am. Sup. No. 2092, of Feb. 5, 1916). (See about "Structure of the Atom," in Sc. Am. Sup. No. 2093).

Prof. Hooke, denies the existence of anything without motion.

Prof. H. A. Wilson's theory is that each atom is made up of a group of electrons, the total number being proportional to atomic weight. Thus hydrogen contains only eight units while gold about 1,600.

Part of Prof. Moseley's table of atomic number of elements reads: Ga. 20, Ti. 22, Va. 23, Cr. 24, Mn. 25, Fe. 26, Co. 27, Ni. 28, Cu. 29, Zn. 30, et.

See for table of revised periodic laws in Scientific American Supplement No. 2089, of Jan. 15th, 1916.

Periodic laws of Frankland and Mendeleief show that "there is a periodic variation in the chemical properties of elements, when arranged in order of increasing atomic weight."

Knetic or dynamical theory of Clausius and Maxwell reads: "The molecules of gases are supposed to be in continuous agitation. . . ."

Later investigations by Prof. Perrin, of so called "Brownian Motion" prove that also "in liquids the particles dart to and fro in irregular and tumultuous fashion and never appear to be at rest for more than a moment."

Still later, Prof. Sir Ernest Rutherford, in his "The Constitu-

tion of Matter and the Evolution of Elements," says: "On the kinetic theory, we thus have strong evidence for believing that the atoms of matter, whether in the solid, liquid or gaseous form, are in continuous agitation and irregular motion." The same author adds, that "it was soon recognized that atoms of the same element always vibrated the same way under all conditions."

Prof. W. C. Mc Lewis of University of Liverpool, in a recent paper, "Capillary and Electocapillary Chemistry" says: "Practically all particles in the stable colloidal or emulsoidal state are electrically charged. In aqueous solution, colloidal metals, sulphides and oil emulsions are negatively charged while colloidal hydroxides and many organic substances are positively charged." The same is claimed in series of text books by Sir Willam Ramsay. This is supposed to be a case of frictional electricity, caused by ceaseless bombardment of the particles or so called "Brownian movement." Prof. Bancroft claims that "these charges are not rigidly fixed and can therefore slip from one molecule to another in a sence parallel to the axis of the tube."

Maxwell and Helmholtz suggestion that electricity is atomic in nature is now definitely established.

By Swedish Royal Academy of Science, in 1914, the Nobel prize was awarded to Prof. Theodore Wm. Richards of Harvard University, for fixing the atomic weight of chemical elements. (World of Science, No. 2643, British).

Prof. Huber says: "Each species has its habits, each individual its peculiar constitution." The same order is stronger noticed in vegetable and still stronger in mineral kingdoms.

Dr. Van der Broek says: "The total number of unit charges on the electrons of an atom is the number representing the position of the element arranged according to increasing atomic weight. Known elements were found to correspond with all the numbers from 13 to 79, e. g. Zirconium 40, gold 79, etc."

Roentgen and Becquarel discovered the rays which render the gases conductors of electricity.

Prof. J. S. Townsend, in "Electricity in Gases," says that "the discharges may be explained by the theory of ionization by collision."

Volta, Lavoisier and Laplace proved that electricity was obtained from evaporation of water, from combustion of coal, and from the effervescence of iron filings in dilute sulphuric acid.

Lenard observed that the air near waterfalls is negatively electrified.

The great German founder of new school of chemistry, Prof. Wilhelm Ostwald, in his "Scientific Materialism," claims that there is only energy in the universe and the matter is only in our imagination, which was soon afterwards admitted by Sir J. J. Thompson and others. Ostwald also claims that "the energy changes are the causes of all chemical reactions."

Sir J. J. Thompson once more proved that the Berzelius theory, viz., that the chemical action is essentially electrical action.

Harry Jones, in "New Era Chemistry," says: "The electrons have mass and are moving with enormous velocities within the atoms. They, therefore, have kinetic energy and a great deal of

it. The velocity of an electron is one tenth of the light."

Prof. J. E. Southcombe, in "Chemistry of the Oil Industry," said: "When we study the results of analyzing a large number of commonly occurring substances, such as sugar, starch, resin, alcohol, fats and oils, we are at once struck with the fact that they all contain only the same three elements, namely: carbon, hydrogen and oxygen. Now, the only possible explanation of the fact is that substances so dissimilar in their nature and properties as sugar and fat can be formed from the same three elements, is, that the atoms of carbon, hydrogen and oxygen are united together in the molecules of sugar in a different way and in different proportions to those in the molecules of fat. In other words, the sugar molecule possesses a different 'constitution' to the fat molecule."

Sir William A. Tilden, in "Scientific Chemistry," page 347, says: "Chemical combination, then, is an affair of atoms, and their joining together or separating is regulated by 'affinity,' by temperature and pressure, and by the mass or relative quantities of the materials presented to each other."

Petroleum and Natural Gas.

Prof. Mendeleief points out that "the appearance of springs of petroleum at the surface of the earth shows the tendency of those mineral oils to traverse by infiltration the different strata of the earth in reaching the surface, a natural consequence of their lower density as compared with water."

S. F. Peckham in "Solid Bitumens," page 25, supports Mendeleief by writing: "It is reasonable to assume, as is now believed, that Pennsylvania oil was not formed in the sandstones, but found its way there by natural agencies from lower strata, probably the Devonian shales."

Similarly writes Henry P. Westcott in "Hand Book of Natural Gas," page 15: "The fact that the very lowest rocks of the Trenton limestone yield the greatest known gas pressure, amounting in New York to 1,500 pounds to the square inch, indicates that all of these different horizons are supplied from a common source, and that it is not indigenous to the strata in which it is found stored. This common source is probably deeply covered by Paleozoic rocks which have been more or less disturbed by folds that have produced slight fractures in the strata. These have served as vents for the passage of natural gas into the overlying porous strata, where it is found today. Many of these sands contain large quantities of petroleum, but pools of natural gas are much more generally distributed and occupy a much larger area than the pools of petroleum, both of which have a common origin."

The origin of oil and gas in the lower strata may find its explanation of the researches of Heraeus, Huppe, Winogradow, and in a recent article by H F. Osborn, in Scientific Monthly, Vol. 3, No. 3, P. 289, 1916. The prototrophic or "primitive feeder," a rock eating bacteria, was living on the earth, in its early days, in great abundance, and is still found in Alpien mountains and other places in Europe. The body of this bacteria is a veritable chemical laboratory and it was a cause of fast decaying of the

rocks, that may explain the presence of the greatest pressure of the gas in lower rocks and its later infiltration into younger, overlying strata up to the surface of the earth, where it is often found today. This is not to be understood as an attempt to dispute the proven vegetable origin of the oil of many fields, yet it cannot be denied that it is a distillate of the scrap heaps of the world and contains almost everything in it.

That bitumen is very strong in "Brownian movements" was proved through colloidal chemistry by Clifford Richardson, preceded by experiments of Prof. Ostwald, the great German expositor of colloidal chemistry. Now the colloids are even photographed by placing the lens of a cinematograph camera over the eyepiece of the ultramicroscope magnifying 1,600 times. When projected on a screen, the colloids appear as large as marbles and exhibit amazing activity. The size of the largest colloids are about four millionth of an inch in diameter and they cannot be filtered or settled out of a liquid, thus finding their way through rocks to the surface, where their presence can be detected by chemico-microscopical, electro-chemical, or, preferable, elctro-mechanical tests and botanical observations, and serve as guides, even where stratigraphy, petrography and other means fail.

Missouri Miner writes: "Negative information is not without value. It may save oil men expenditure of many thousands of dollars in fruitless drilling. 'Forewarned-forearmed' applies to oil well drilling as much as to weather predictions. As the cost of putting down a well is great, drilling should preferably not be undertaken in a new region until a careful geologic examination of the surface has been made and the most favorable area determined. The geologist can not tell from a study of the surface alone whether or not oil occurs beneath the surface, but he can designate areas in which it is extremely unlikely that oil may occur and other areas in which the structure is favorable to the accumulation of oil."

After pointing out that "oil and gas are found in nearly every formation in the entire geologic series, porous enough to contain it," J. C. McDowel, on Chicago Mining Congress, in Nov. 1916, added: "In general it must not be understood that such forecasting is a simple matter, for it is not. At best there are many chances of failure, even after a possible trap is disclosed upon the surface of the ground. Not only is there a danger of the trap flattening before porous strata are reached, but there may be no porous strata underneath. Again, there may be some denser impervious area intervening on the slope, preventing the oil and gas from collecting in the dome or trap; and last, there may be no gas or oil in any of the formations tapped." Above is a correct picture of the delicate situation of the geologist without the help of electric instruments, which would indicate the presence or non-presence of the oil or gas. Any dome not having excessive electrical currents, at least at certain places, is hopeless for oil or gas prospects, regardless how favorable the strata may lie. Every dome is not an oil field. Every cow is not milking. Every house is not home.

While the anticlinal theory of oil and gas accumulation is

generally accepted and is right, there are, perhaps larger oil and gas bearing areas where such conditions are not present, and, in possible absolute absence of any surface indications, the electric prospecting is the only means to determine the location and extent of such valuable strata; likewise lands where the rock is deeply buried under alluvial or glacial drift, or places where it is impossible to see the structure of the oil bearing stratum from surface, in account of it being, either underlaid or covered unconformably, by worn out, crumpled and faulted formations of earlier or later geological times. In such cases a few feet in any direction in locating the well sites, may mean failures or successes. Following valuable lines are written to this account by C. D. Smith, of U. S. Geol. Survey, in a Bulletin No. 541, page 45: "Where gas, oil and water, which have different specific gravities, occur in porous medium, like a sandstone, where interchange of position is but slightly hindered, the tendency is that the gas should be forced to the highest available point, whereas the oil would lie below the gas and the water below the oil. This relationship would obtain, provided the containing medium was uniformly porous, but in fact it is not, hence a number of modifying factors, some of undeterminable importance enter the list of possibilities that must be considered (page 46), such as lack of continuity of the sand in one direction or another, irregular 'pay streaks' and various other factors undeterminable from mere study of the surface strata (page 47). But reservoirs are produced as effectively by a combination of monoclinal dip and lack of porosity or absence of a sand as by anticlinal structure. The gas and oil followed by water, will travel up the rise until a zone in the containing sand is reached, where the sand either pinches out or becomes impervious or 'tight;' thus, an accumulation of oil and gas in a given sand is likely to have an irregular or ragged boundary," what makes it still more expensive, risky and practically impossible to follow by haphazard drilling. The same author adds: "It appears, therefore, that vagaries in the development of porous parts or 'pay streaks' in a sand may produce reservoirs where little favorable geologic structure is evident."

"If oil and water are not associated, the petroleum moves downward, along bedding planes and through coarse, porous strata, under force of gravity. In such case it may occur in pores at the bottom of a syncline," (Illinois State Geological Survey Bulletin No. 16, page 54) where it would be looked for the least by a practical driller or prospector.

Investigations of M. J. Munn, of the United States Geological Survey, in Appalachian oil fields (see Economic Geology No. 2 and 6 of vol. 4, 1909) also prove that the accumulation of oil occurs not only in anticlines. The same is explained by L. C. Snider, in Petroleum and Natural Gas in Oklahoma (page 16-17); by F. G. Clapp, in Economic Geology (vol. 5, No. 6); by W. T. Griswold, E. H. Cunningham Craig, and many others.

All such exceptional, as well as normal cases, can be detected by an experienced electric prospector from the surface of the ground and all useless expense avoided, making allowances for certain exceptions, mentioned in next paragraph.

Failures Possible.

There are certain exceptional cases where even the best expert, armed by all scientific knowledge and devices, may fail, e. g. in oil business, where it would be impossible to determine from geological standpoint the depth of the oil bearing stratum and the drilling may be stopped short of reaching to it. Instruments would verify the favorable location but fail to indicate the depth, though it is claimed by some instrument sellers. The valuable deposit may be too deep down to be reached by our technical means, yet instruments would correctly indicate its presence in certain places. Lateral migration of oil and gas in small quantity, near to the surface, may be misleading in some cases, causing strong currents on account of its nearness to the detecting device. Oil not filtered out of shale, in absence of reservoir rock, would give oil indications, but would be unobtainable without extracting it by refining. Small "tight lense" in oil bearing sand may be a cause of a dry hole, though electric currents may not be normally less on that spot, if the sand is fairly deep down. Narrow oil or gas bearing "streak" in heavily dipping strata may be missed by miscalculation of its angle of dip, which may be different lower down than at surface. Electric currents would be the strongest at the point nearest to the source, but in such case it would not be the favorable place to drill. Outcrops of petroliferous strata, on or near the surface, without the study of geology of that locality, would encourage drilling on the strength of electric currents, yet the weathered strata would not produce in paying quantities and lower sands may be barren. Along the cleavages of the strata the electric currents travel four times better than cross cleavage and so help to mislead a careless or ignorant prospector at the places where the strata outcrops or pinches out close to the surface, though the oil and gas may be retarded by tightness of the strata or other causes lower on the slope. Certain oils are too heavy to be strained out of sand, or so called rock asphalt—causes also oil currents, being it in substance. Like is the result in case of asphalt beds. Drilling hole full of water will present oil showing up, though it is there and instruments would record it. L. G. Huntley, of Bureau of Mines, in Technical paper No. 51, states: "In drilling by the wet method in the early days, the water pressure prevented some minor oil 'pays' from indicating their presence. These have since been developed and some of them have proven large producers." Electro-chemical action is about the strongest at points of contact of oil with salt water, but such places must be avoided as well sites. The strength of the terrestrial electric currents, as these of atmospheric, are subject to almost continuous change, dependent of many factors, like moisture of the ground, humidity of the air, temperature of the ground and air, seasons of the year, time of the day or night, distance from poles, barometric changes, altitude, chemical composition of the ground and rock below it, and many other factors, like planetary disturbances, aurora borealis, etc. Terrestrial electricity is at its minimum just before sun rise and after noon at hottest time; maximum—just after sun rise and after sun set. To know to compensate for such changes, the

prospector must carry hygrometer, barometer, ground thermometer and other instruments with the prospectoscope, otherwise mistakes may occur, unless the same ground is prospected under all conditions and several times. Some guidance can be had from producing wells in neighborhood, where this is possible. The electric currents near a well are not to be depended as a guide if all the conditions are not fully known, e. g., at the start of the production the currents are larger than normal for the quantity of the production, owing to the increased migration of the hydrocarbons, if the flow is hindered, like the case is with flowing wells and gassers, while later they gradually decrease, until, at the exhaustion of the well the currents are small, similar to ground where no hydrocarbons are present. Such conditions may not be, or are very slightly noticed if there are more productive sands below the drained one. Therefore, the electric prospecting, wherever possible, must not be taken as a sole guide, especially in new and unknown territories. Most, if not all, of the above mentioned failures can be avoided by a careful study of geological conditions. Thus, it is evident, that a certain degree of risk remains in this, like in every other business, but it is reduced to minimum with the help of skilled electric prospecting, and up-to-date drilling methods.

Conclusion.

As in Miller's, so in other instruments, and so in common "divining rod," or whatever name or device it be, the electricity is the indicator. Everywhere in the ground are electric currents present, to some extent, but more in places where large bodies of ore, oil, gas or water are under the ground.

Nothing in the universe is totally ruined or fully finished. Everywhere is going on a building up of a new and tearing down of old; so in the human body, so in ore body, oil, gas, or whatever it be. So it is going on in all the universe, from suns to electrons—all and everything being under the same laws. Where any action takes place—energy is used or liberated. The larger the action in certain places, the more is there available energy, and it can be detected and measured by suitable means.

We are now told by reliable authorities that all matter and energy are the result of electric activity, consequently, where any certain element is in excess, there also is electric activity correspondingly so, and vice versa.

From foregoing we know that every element has its own characteristic arrangement and different number of electrons in the atoms. If we capture by a suitable instrument the comet like electrons mentioned by Prof. Poincare and make them unite as explained by Prof. Sir Rutherford and Prof. Tyndall, they will arrange in their original order like they used to be in the atoms of the elements they left. At the time of such sudden reunion a characteristic sound is heard in a sensitive telephone receiver, if connected with the apparatus.

The electricity of every element has its own sound, strictly corresponding to tables of atomic weight of above mentioned professors: Wilson, Moseley, Thompson and others.

Thus, every element has its own specific gravity, its own atomic weight, its own chemical properties, its own X-rays, its

own characteristic vibrations of electrons in molecules, and, as a consequence: Its own characteristic electric currents, which, when transmuted into sound—are easily distinguished from each other by a trained ear. It is a fact we are facing—not a theory, and a fact as certain as the sun.

The sounds produced by different elements differ in account of their different distances of the electrons in construction of the molecules, their varied rotating speed around the central nucleus, and of the quantity of the electrons in a given molecule. The electrons of an element distanced farther from the central molecular nucleus and from each others, and being fewer in quantity, would strike the instruments' detecting parts fewer times in a given time, and so cause a lower tone than elements of higher evolution and more dense construction, or somewhat resembling the lately invented electric organ, which plays musical notes, detectable by any wireless receiving instrument. It is based on the principle that wireless sparks discharged in rapid succession produce a musical note, the pitch of which depends on the rapidity with which the sparks are discharged. The later finding its similarity in the, known to everybody, violin or piano string: The stronger it is strung the faster and narrower are the vibrations and the higher the tone. The same is the case with everybody's voice. Thus we find resemblances everywhere in the nature, though they do not look alike at first sight. There is as much difference in the sounds of electric currents of elements as in the sounds of widely related living beings.

Human voices are photographed and are found to differ like faces. So is the case with minerals. Like you recognize a voice talking to you by telephone, or the voices of your beloved ones, from far away, so an experienced electric prospector identifies the sounds of electro-chemical vibrations of diverse minerals. It is like pouring, or dropping, drop by drop, different liquids on a resonant instrument, like a drum. Soon one would learn to distinguish the liquids by sounds, not looking at them, owing to the varied sizes and densities of the drops causing the sounds.

Above claims will not look exaggerated to one who knows about Dr. DeForest's Oscillating Audion, making all kinds of sounds.

Those claims are also strongly supported by the invention of Mr. Cutton, (mentioned above) what is a modification of Hughs induction balance, and was recommended by Paris Academy of Science for locating unexploded shells in the erstwhile battlefields. In Scientific American of Nov. 13, 1915, we read: "The apparatus, which was thoroughly tested, is so sensitive that its user can detect by the sound in the head telephones the proximity of a mere scrap of a shell on or near the surface of the ground, or even a tin can. The note sounded by a shell fragment differs from that caused by a buried shell, so that the trained ear easily distinguishes between the two. Fragments of shells or tin cans or boxes, on or near the surface, produce a sound as intense as that made by a deeply buried shell, but it is easy to distinguish between the two. . . ."

While Cutton's instrument is as perfect as can be expected

for purposes mentioned, it cannot be used for detecting any mineral deposits deep in the ground, (unless lowered to it) as, on the principles its construction is based, its induction coils would have to be enlarged enormously, according to increasing depth of the mineral, and it would make it impossible to handle it in any deep prospecting works.

Miller's instrument is adaptable for any jungles, is small, exceedingly sensitive, of quick action and of simple construction. It can be used anywhere where a good contact with the ground can be had, and the deep seated sources of electric currents are as will be detected as surface deposits; the strength of the current only being different, but preserving its characteristics.

One learning the sounds of the electric currents of elements, will be able to know the presence of them. In cases of composed bodies, more than one sound is heard at the same time, but each can be traced home, like one recognizes the sound of a certain instrument in full play of an orchestra. All conditions being normal, the strength of the sound corresponds with the quantity and depth of its source; though, geological and other above mentioned conditions must be had strictly in view.

Wherever in the ground are ores, oil, gas, water, etc., in large quantities, there are remarkably large electric currents in the ground above it. The ground and rock, being in direct contact with such body, and being fairly good conductor of electric currents, conducts this energy to any and everything electro-conductive on the ground, be it tree, grass, animal or an apparatus for collecting the energy. Thus in a human body, walking on the ground, under favorable conditions, is as much electricity as in the ground below it; hence, the explanation of the phenomenon of water finding with a common twig by certain individuals. By holding in the hands a twig, or connecting his hands without it, his body is turned into a "horseshoe magnet," his hands and feet representing opposite poles and causing convulsive movements in his hands, or in the twig held in the hands, resembling the well known experiments of Galvani with a frog.

Rock and ground, laying on mineral deposits, are in direct contact with the mineral; the latter, as above explained, is in continuous molecular agitation and in endless transformation, and, therefore, is a source of available energy, it is, electricity. Any suitable device, coming into direct contact with the ground above such action—is, in fact, in direct contact with the source of it.

To detect such currents is a case identical to common electric wiring. The mineral and ground being the battery end and the apparatus or human body the electric bell or light end with detecting means, or some-how resembling the "plunge battery" of Prof. Hopkins.

The presence of moisture in the rocks is essential for good conductivity of electric currents. Prof. H. Geikie, in *Textbook of Geology*, page 298, says: "By numerous observations it has been proven that all rocks within the accessible portion of the earth's crust contain interstitial water." This applies most truly to rocks above oil and gas deposits, where the "cap-rock" serves as a good reservoir bottom.

Especially conspicuous are the electric currents in cases of oil or gas being in the ground to be prospected. The rock and ground, even most impervious, is full of microscopical pores and fractures, resembling a sponge in miniature, and, the gas and oil being under large pressure, subject to kinetic and gravitation laws, is working its way slowly, but surely through such pores, possibly only in atomic quantities, and not visible by seapages or detectable by chemical or microscopical tests of the ground, but unmistakably betraying their presence by excess of electric currents in the ground above such deposits. Oil and gas mixed with the ground are a good source of electric currents.

Oil Age writes: "So far it has been discovered by the U. S. Government Bureau of Standards that electric currents of considerable magnitude can be produced by filtering gasoline through chamois skin or through some other insulating media." Like action takes place in the ground and rocks where oil or gas is working its way to the surface, or water its way down, subject to gravitation and kinetic laws. By working their way through countless small crevices and pores in the rocks, the liquids and gases are divided into a multitude of infinitesimal small parts, continuously uniting and breaking up again. Their aggregate surface is very large, and being exposed to unceasing friction and physico-chemical reaction, is a source of resulting electric currents. This explains the phenomenon that leaks in buried water mains can be detected from the surface by "divining rods," while the water main itself can be located only by magnetic devices based on induction balance. No electro-chemical action, of any extent, takes place in the water of the main, and the friction surface against the walls of the tubing is too small to cause recordable currents, while all favorable conditions, for generating electric currents, are present at the places of leaks. Lord Kelvin electrified air by forcing bubbles through water.

"Gases are elastic fluids in which the molecular force of repulsion is superior to the force of attraction. Expansion the most characteristic property of gases, is due to this force. The limit of the expansive force of gases is unknown. If there were no opposing causes, it would appear that the particles of gas might separate indefinitely;" (Hopkin's Experiential Science, page 85) thus filling all pores in the rock or ground on its path, making a good flow of electric currents possible, for, we know that gases are good conductors of electric currents, and giving a raise of such currents through collision and physico-chemical action on the particles of the rock and ground. "Ninety per cent of oil is accompanied by gas," (Craig, "Oil Finding") thus helping the detection of each other.

Wallace, in "The Wonderful Century," claims, that "there are hundreds of trillions of molecules in a cubic inch of gas, colliding with each other and surrounding bodies eight thousand millions of times in a second."

"The present stage is but a phase of the endless cosmic cycle. Condensation—collision—nubulae; then condensation, collision, etc. again. The Creator has not finished his work and never will. He is ever present, ever working throughout the universe—an Infinite

and Eternal Energy," says C. M. Kilby in *Popular Astronomy*. A single atom is a model of our stellar system and of the whole universe, it is borne, lives, dies and is borne again and again like we, like everything. Nothing is lost in this giant melting pot. Only the electrons changing their temporary unions. Such changes, where it takes place in very large scale, like at the oil and gas pools and ore deposits, or where it takes place forcefully, like in Radium—can be detected by sensitive instruments fitted for such purposes.

If electricity is a cause and result of every movement as expressed by many scientists, then is the case also so and it can be detected and harnessed by suitable means, as explained by Tyn-dall, Rutherford, and others. It is obvious, that a suitable scientific instrument, in skilled hands, is of incalculable value in prospecting, and millions of dollars can be saved annually, now wasted on useless drillings and shaftings.

From the foregoing, it is evident that there are no mystic powers connected with locating minerals, but let no man be deceived by these words, by imagining, that possessing one of such instruments he would be a successful locator. As expressed above, one must possess a good knowledge of geology. It takes many years of practical and theoretical hard study and an analyzing mind to succeed in this line. "A little learning is a dangerous thing."

The electric prospecting can be applied also with great benefit in abandoned or exhausted fields. After the oil or gas wells are thoroughly drained and excessive electric currents still remain—it is a proof that more productive sands are untaped below. There are many "dry holes" that can be made producers with little additional expenses, by drilling deeper, where excessive electric currents and favorable structure suggest it.

There is one more, and a very important use for electric prospecting. It is locating the most favorable places for oil tanks. Generally known is the fact that oil tanks are struck by lightning more often than any other structures. How serious is this question we see from tentative figures compiled by Oklahoma State Fire Marshal in June 1916, where in a single month, in Oklahoma only, not less than \$500,000 was lost in the oil fields, the fires resulting from lightning striking oil tanks. After admitting above advanced theories, it is only natural, and the cause evident to anyone with an elementary understanding about electricity. Messrs. C. W. Shannon and L. E. Strout, in a Bulletin No. 19 of Oklahoma State Geological Survey, page 38, write: "There is general belief among oil men that certain localities are more subject to the effect of lightning than others," and that "it is also claimed that tanks located on the prairie, away from the oil fields, is the best location. Actual observation tends to prove this," etc. Safe places, or minimum danger places can be located in the oil fields by electric prospecting and many millions of dollars can be saved annually, now going up as smoke, after the big expenses getting the oil out of the earth. Where the terrestrial electric currents are the weakest, there is the safest place for a tank and vice versa.

Afterword.

How hazardous, for instance, it is in petroleum drilling, without scientific guidance, is proved by the words of Mr. Stebbins of Oklahoma. Leasing 22,000 acres of ground, and paying \$64,000 bonus, drilling 28 dry holes before getting a barrel of oil, and only 40 acres out of 22,000 were productive.

By electric prospecting all this loss could be avoided.

And what a proven oil field is worth, we see from the following: (Arkansas Gazette, March 4th, 1915) "Washington, D. C., March 3rd.—The Murray resolution establishing a 440 acre domain for Creek nation from unallotted lands of the Cushing oil fields of Oklahoma was passed by the House today and sent to the Senate. Representative Murray said the tract was worth \$30,000,000.00." To prove that this estimate is not exaggerated, we use the words of Mr. W. S. Blatchley: "It is estimated that Spindle Top Hill, in Texas, produced over 25,000,000 barrels from less than 200 acres." (See Illinois State Geological Survey Bulletin No. 2, page 30.)

There is more natural wealth in accessible depth of the Globe than the most optimistic geologist ever dreamed, but the "dry hole" has been the discouraging evil, retarding the progress of the world. To remedy an evil with the greatest practical celerity and thoroughness, find the man who can make a profit by stopping it. That's the natural and scientific way.

Rothschild's business motto is: "Do not reckon upon chance." But the average "wild-catter" is taking nothing but chance. Without scientific guidance and often prejudiced against geologists, the over-optimistic fatalist, when striking sometimes something by accident, is often the prey of some bullying and sneaking, hooking and crooking big organizations, who themselves avoid chance taking and only in later years are getting into the habit of employing scientific brains. While, philosophically speaking, nothing is lost when one puts down a dry hole or an empty shaft and the money only changed hands and is not out of circulation, nevertheless, it is a choke for the progress of the world; for the enterprising man may have got "cold feet" from such experiment, or, spending his last available dollar—is unable to try again. "Life" says very correctly: "It is not the money that is spent; it is the time that is spent spending the money, that causes the damage," for the time of useful hands, wasted, can never be gained again. Thanks only to the enterprising man, the world is what it is, and will be what it ought to be, under proper guidance of cultivated brains in all lines of new enterprises. One goes not to a cobbler when he needs a shave, but the average man is slow to imagine the existence of a science beyond his ken. One often hears oil men saying: "The geologist guesses—I'll guess myself and save the fee." An up-to-date geologist "guesses" nothing. For every one of his opinions he has a stepping stone, as rigid as the laws of nature; and, even if it was only a guess, he would be a better guesser.

Reliable statistics prove that of the wildcat wells located without reference to geological conditions in Oklahoma more than 90 per cent are failures, while 60 to 75 per cent of wildcat wells lo-

cated by geologists are producing oil or gas. With the help of skilled electric prospecting this can be increased almost to 100 per cent.

This is a line where flattery of unintelligent public and stern avoidance of ideas will not bring success.

Concluding with the words of Sir Sidney Burrard: "I have now had the great privilege of placing certain problems before you, and suggest for your consideration."

